

March 14, 2012



Office of Electricity Delivery & Energy Reliability



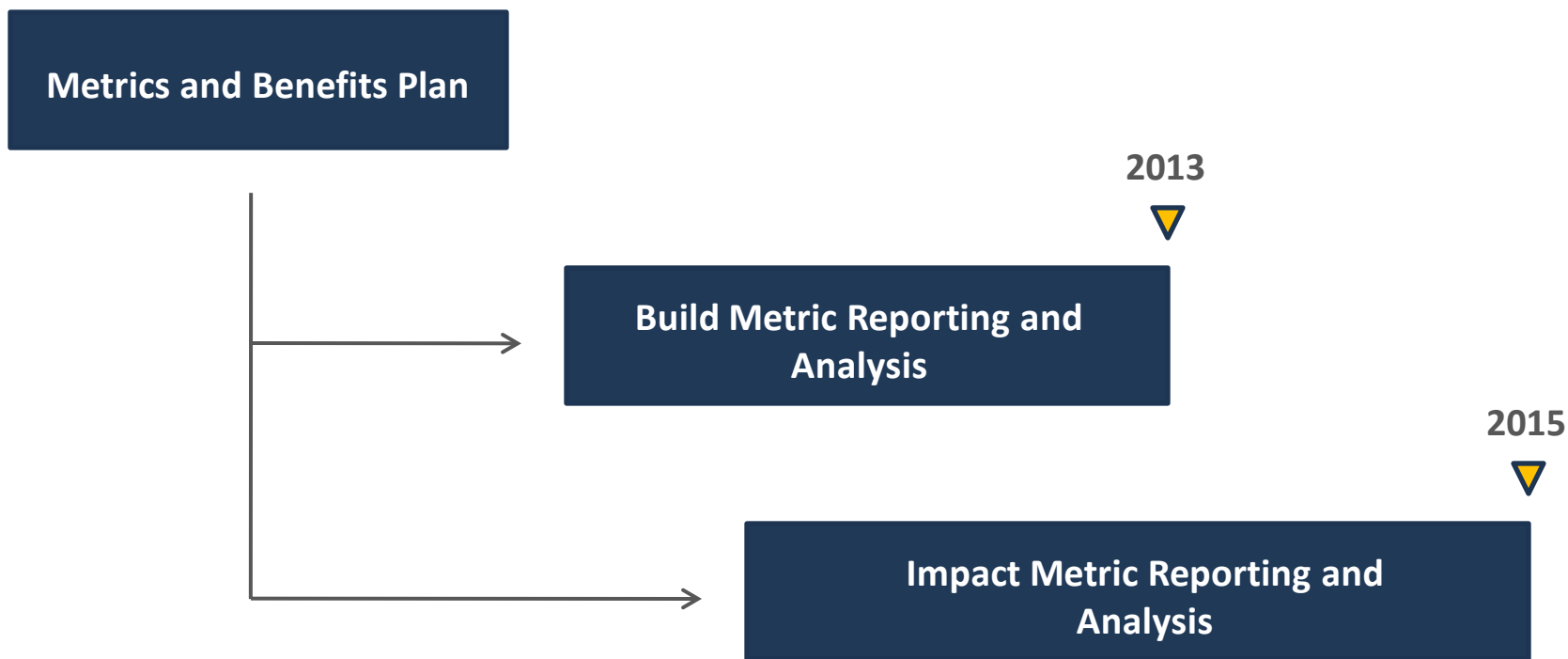
Operations and Maintenance (O&M) Savings from Distribution Automation

DOE Analysis Approach



Introduction

Build and impact metric data provided by the SGIG recipients convey the type and extent of technology deployment, as well as its effect on grid operation and system efficiency.





Six Primary Analysis Focus Areas

There are six areas where the analysis is focused. This presentation addresses analysis efforts associated with O&M savings from Distribution Automation.

Peak Demand and Electricity Consumption

- Advanced Metering Infrastructure
- Pricing Programs and Customer Devices
- Direct Load Control

Operations and Maintenance Savings from Advanced Metering

- Meter Reading
- Service changes
- Outage management

Distribution System Reliability

- Feeder switching
- Monitoring and health sensors

Energy Efficiency in Distribution Systems

- Voltage optimization
- Conservation voltage reduction
- Line losses

Operations and Maintenance Savings from Distribution Automation

- Automated and remote operations
- Operational Efficiency

Transmission System Operations and Reliability

- Application of synchrophasor technology for wide area monitoring, visualization and control



DOE/Recipient Dialogue

DOE would like to establish a dialogue with recipients to explore O&M savings from Distribution Automation using equipment monitoring, remote equipment control and condition based notifications. The outcome is to share this information across the industry.

DOE's Interests	Recipients' Interests
<ol style="list-style-type: none">1. Analysis Approach: Working through issues relating to measuring impacts<ol style="list-style-type: none">a. Analytical methodologyb. Baseline/Underlying factors leading to resultsc. How to convey the results and to whom?2. Lessons-Learned/Best-Practices: Internally and externally conveyed<ol style="list-style-type: none">a. What can we learn from each other?b. How do we want to document lessons-learned and best practices for external communication?c. Are there detailed case studies that can be developed?	<ol style="list-style-type: none">1. What would you like to address in a group setting?2. What do you want to learn or share?3. How would you like to exchange information?<ol style="list-style-type: none">a. In smaller or more focused groups?b. How should we structure and support the discussion?4. Are there issues you are NOT interested in addressing here?



DOE's Analysis Objectives

This focus area will examine O&M savings from Distribution Automation (DA), i.e., by exploring DA system functionality through utilization of automated switching, substation and feeder monitoring and equipment health sensors.

Analysis Objectives

- Determine the amount of operations and maintenance (O&M) savings achieved by and Distribution Automation (DA) projects.
- Determine what technology configurations are most important for delivering measurable results.
- Quantify the operations and maintenance savings from distribution automation.

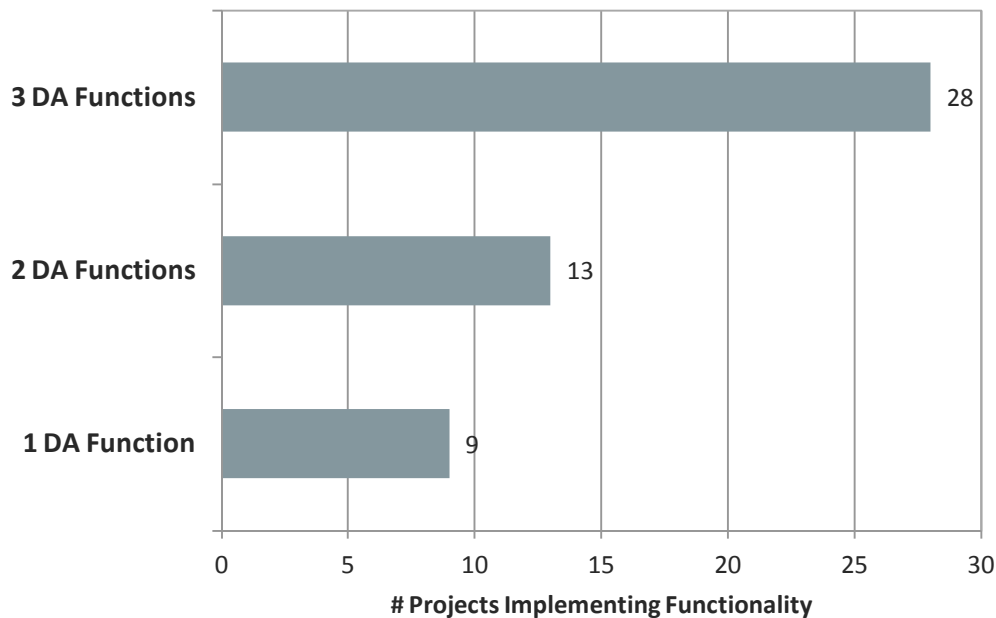


SGIG Projects

SGIG projects are implementing different technology configurations to reduce distribution operation and maintenance savings.

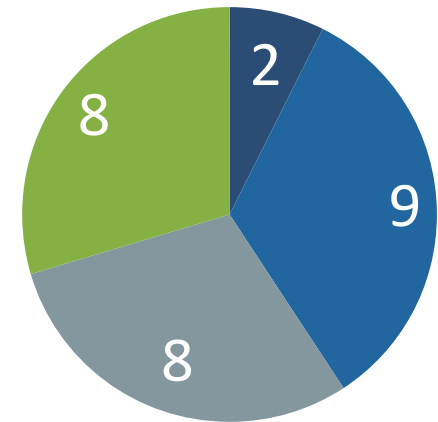
50 SGIG Projects Implementing Automated Distribution

Distribution DA Function being implemented



A function represents one of the following: Equipment Monitoring and Diagnostics, Automated Feeder Switching, or Voltage Optimization.

27 SGIG are integrating their DMS with other systems



- Integration - 1 system
- Integration - 2 systems
- Integration - 3 systems
- Integration - 4 systems

A system represents one of the following: AMI, Distributed Energy Resources, OMS, or Transmission Management.

Source: SGIG Build metrics and Navigant analysis



Technologies

SGIG project teams are deploying a variety of different technologies.

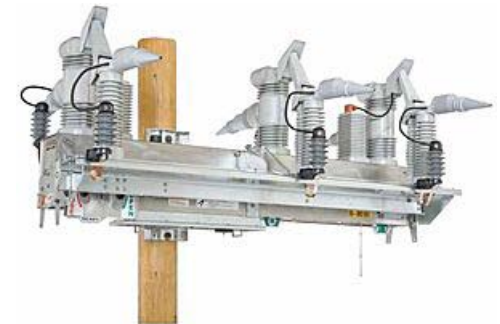
Automated Switchgear



Automated Capacitor Banks



Automated Feeders Switches



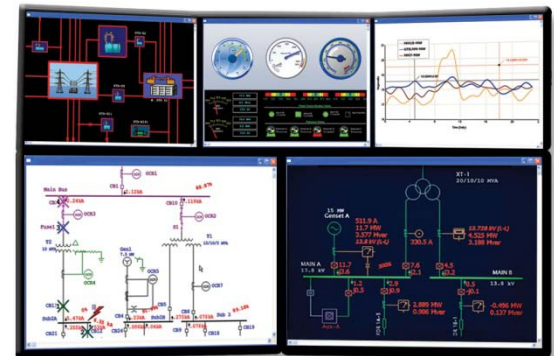
Transformer Monitor



Equipment Health Sensor & Monitor



Distribution Management System





Applications of Distribution Automation

DOE has also observed projects that are using a combination of monitoring equipment, remote equipment control and condition based maintenance to reduce O&M costs.

Remote Equipment Monitoring and Data Acquisition

Utilizing two-way communications, substation and distribution equipment monitors to remotely monitor conditions and acquire data from sensors.

Remote or Automated Equipment Control

Utilizing two-way communications, remote or automated equipment to control substations or feeder devices. Operators may actuate equipment for reliability, efficiency, or maintenance purposes.

Condition Based Maintenance

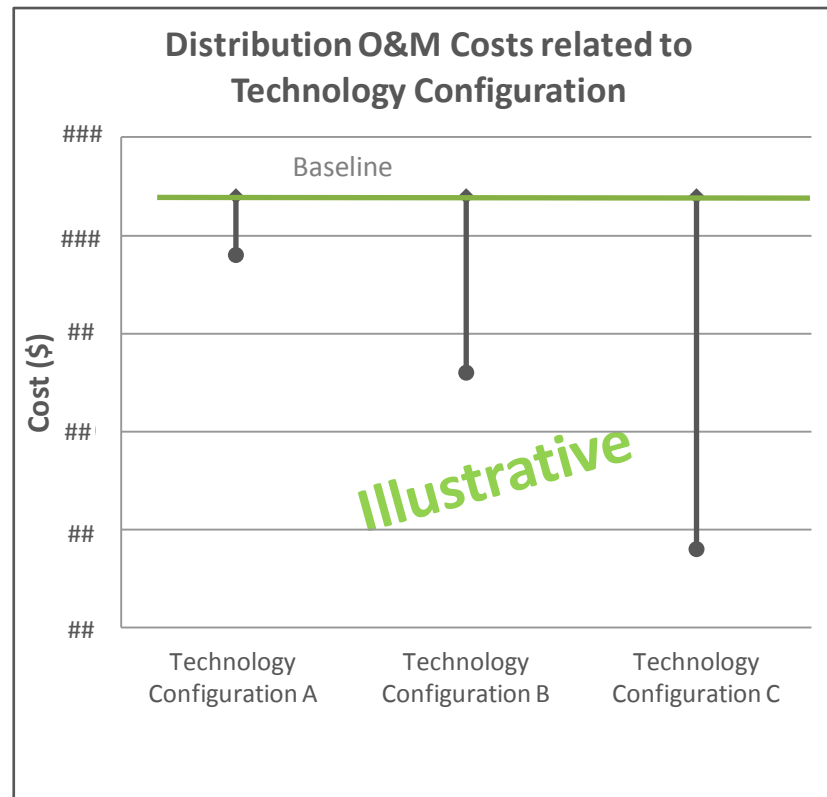
Utilizing remote condition monitors, data acquisition systems, and analytics to transition from preventative (schedule based) to condition based maintenance.



Functionality and Impact Hypothesis

Our hypothesis is that relative benefits will increase with higher functionality from substation monitoring, feeder monitoring, and automated feeder and capacitor switching

Group	Distribution Automation Scope
A	<ul style="list-style-type: none">Substation Monitoring and SCADA
B	<ul style="list-style-type: none">Substation Monitoring and SCADA and feeders with line or transformer load monitors
C	<ul style="list-style-type: none">Substation Monitoring and SCADA, Feeders with Line or Transformer Monitors and Automated Feeder or Capacitor Switching





Build and Impact Metrics

Build and Impact metrics will track the deployment of technology and how it affects operational efficiency.

Key Build Metrics (Technologies)

- Portion of system with Distribution Automation (DA)
- Portion of the system with SCADA
- DA Devices
 - Automated Feeder Switches
 - Automated Capacitors
 - Automated Regulators
 - Feeder Monitors
 - Remote Fault Indicators
 - Transformer Line Monitors
- Distribution Management Systems (DMS)
- DMS integration with Outage Management System (OMS)

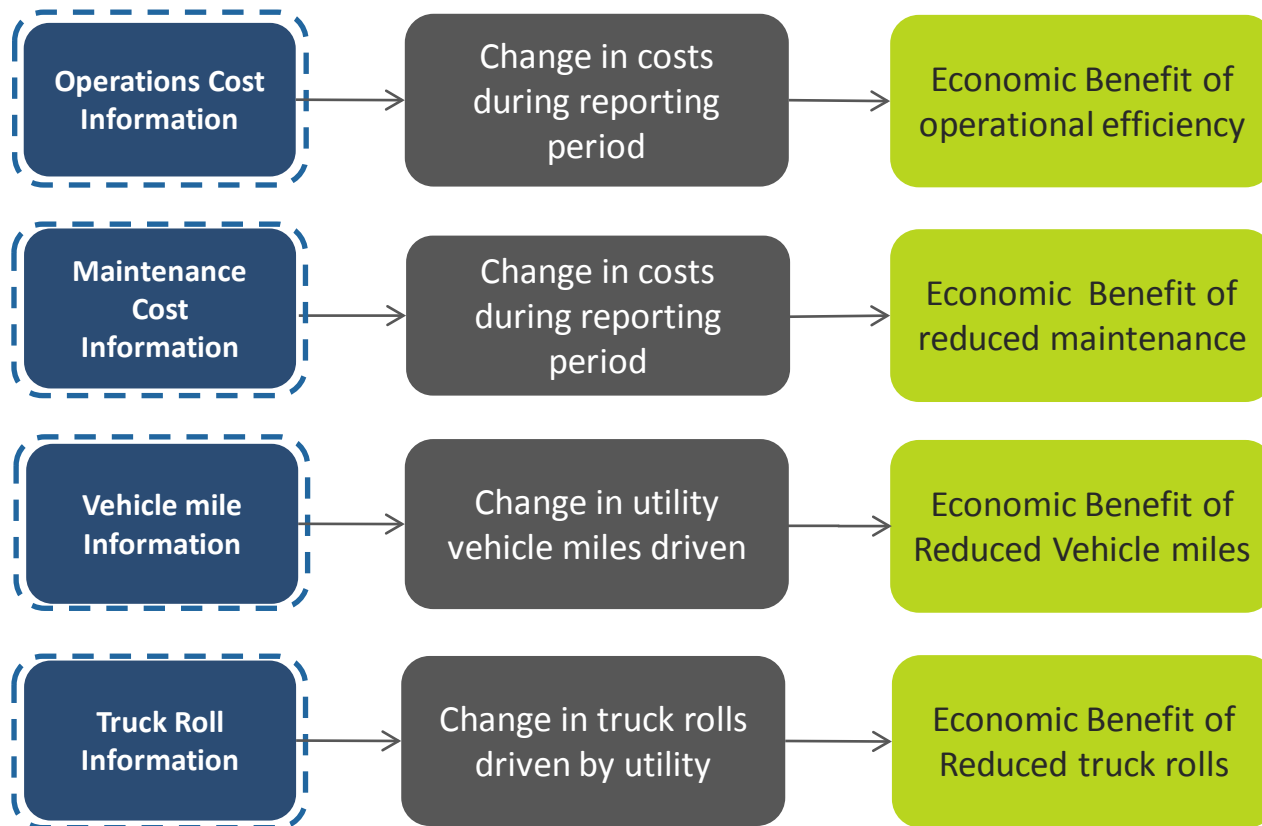
Key Impact Metrics

- Distribution Operations Cost
- Distribution Feeder Switching Operations
- Distribution Capacitor Switching Operations
- Distribution Maintenance Costs
- Outage Restoration Costs
- Truck Rolls Avoided
- Distribution Operations Vehicle Miles



Logic for Analyzing Distribution O&M Savings

DOE will analyze O&M costs and other impact metrics to calculate the economic benefits of smart grid technologies.



Legend

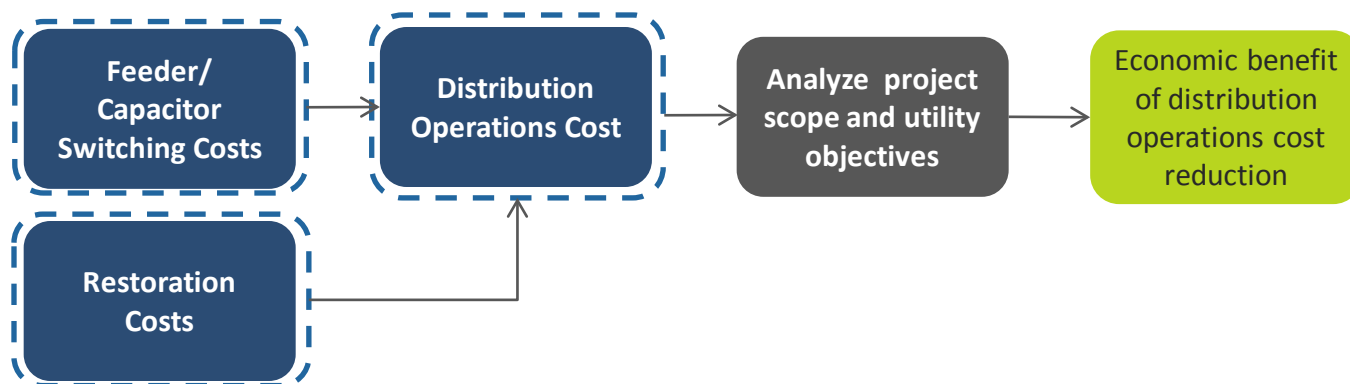
- Impact metric
- Change in Impact
- Analysis
- Benefit



Distribution O&M Costs

DOE will analyze O&M costs and other impact metrics to calculate the economic benefits of smart grid technologies.

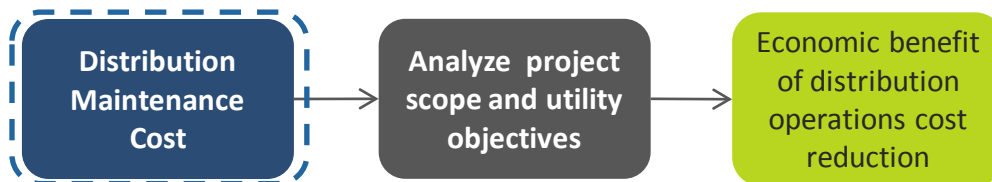
Distribution Operations Cost Analysis



Legend

- Impact metric
- Change in Impact
- Alternative Impact Metric
- Analysis
- Benefit

Distribution Maintenance Cost Analysis

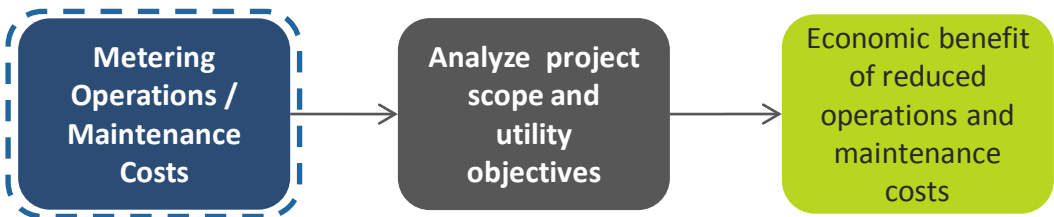




Distribution O&M Costs

DOE will analyze changes in distribution operations and maintenance costs to calculate utility operational benefits.

- These results will be accounted for and aggregated in the Distribution Operations and Maintenance Savings Focus Area.



Distribution Maintenance Cost Calculation:

$$\text{Value (\$)} = [\text{Total Distribution Equipment Maintenance Cost (\$)}]_{\text{Baseline}} - [\text{Total Distribution Equipment Maintenance Cost (\$)}]_{\text{Project}}$$

Distribution Operations Cost Calculation:

$$\text{Value (\$)} = [\text{Distribution Operations Cost (\$)}]_{\text{Baseline}} - [\text{Distribution Operations Cost (\$)}]_{\text{Project}}$$

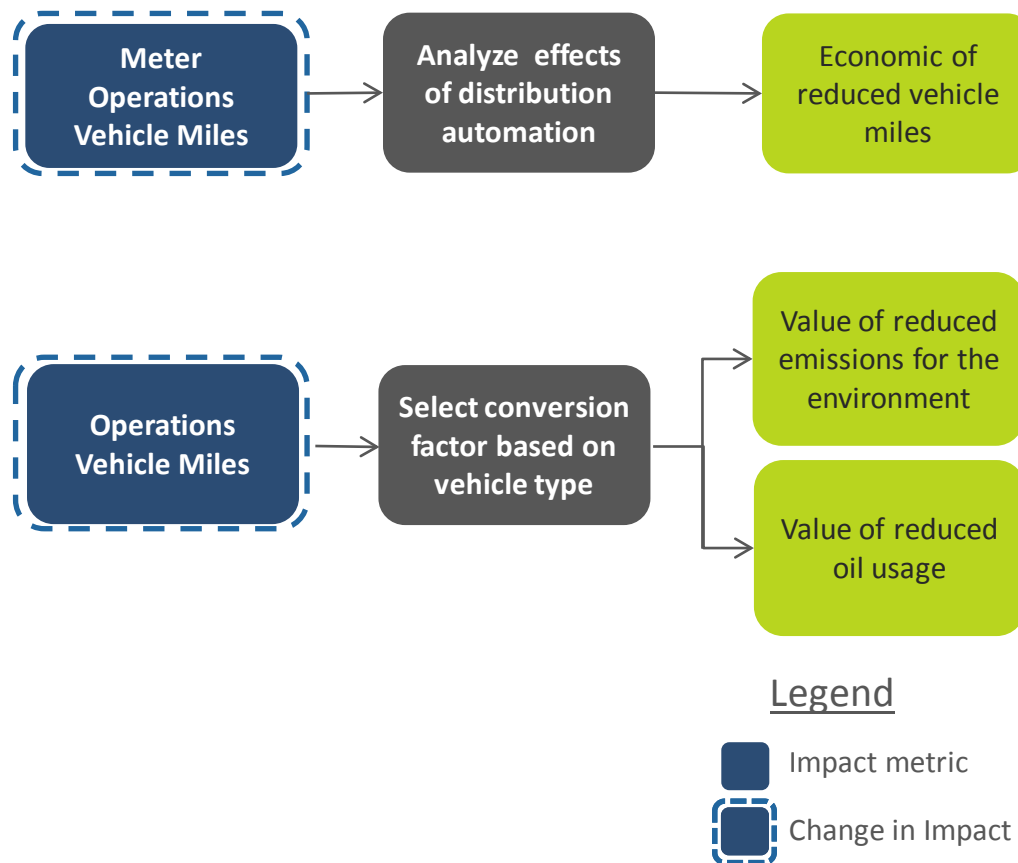
Legend

- Impact metric
- Change in Impact
- Analysis Objectives
- Benefit Calculation



Value of reduced vehicle miles

DOE will analyze the effect of different technology configurations can contribute to determining the change in vehicle emissions.





Additional Analytical Questions

- What other kinds of impacts are project teams expecting, and how should we be looking for them in the metrics data?
- What other kinds of data or information can be shared to help the group understand impact?
- How are utilities operating distribution automation equipment and leveraging information to reduce O&M costs, and how can that shared?
- How are baseline and avoided costs being established?